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The objects found were some of them similar ; others only analogous. The polished stone hatchets, and similar implements, were the most numerous. They were not nearly so well made nor so complete as those from other countries. The material is usually a fine, hard, compact and siliceous schist, sometimes yellow or gray, other times black, frequently made of a pebble with remains of its original crust apparent. Some of them would indicate a new method of handling, for they have a straight stem or tang, as large square as the thickness of the hatchet, and which is cut down at the edges so as to make shoulders. The tool most plenteous is the adze. Its sharpening is all done from one side. Gouges are found, though not so common. They are made in the same way as were the adzes, except that the edge is polished. Objects of shell are frequent ; bracelets, rings, and beads are made of this material. It also served for scrapers and cutting implements. Objects of bronze were not found, but those of copper were.

Mr. Jammes is Director of the Royal School of Cambodia at Phnom-Penh, and he displayed his collection at the International Congress of Anthropology and Prehistoric Archæology held at Paris last summer.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

The American Geological Society.—At its late meeting in New York, December 26-28, the following papers were presented (Continued from the NATURALIST, February, 1890, page 212.):

ON THE TERTIARY DEPOSITS OF THE CAPE FEAR RIVER REGION. William B. Clark, Baltimore, Md.—The Eocene occupies small detached basins within the Cretaceous, while the Miocene extends widely over Eocene and Cretaceous alike.

Post-Cretaceous erosion left an irregular surface over which the older Tertiary deposits were scattered. Post-Eocene erosion approximately base-leveled this surface, leaving the early Tertiary sediments preserved in the deeper Post-Cretaceous depressions. Upon this base-leveled surface the Miocene strata were laid down.

An intermingling of numerous characteristic Cretaceous species with Eocene forms was observed at several places ; likewise of *Exogyra costata* with Miocene types.

CRETACEOUS PLANTS FROM MARTHA'S VINEYARD. C. D. White, Washington, D. C.—The topics treated in this paper are : Review of

opinions respecting the age of the Vineyard series; plants found at various localities in that series; the Gay Head flora cretaceous; its distribution and affinities; mode of occurrence; eastward extension of the Middle Cretaceous; origin of amber in the Vineyard. Illustrated.

THE GEOLOGY OF THE CRAZY MOUNTAINS, MONTANA. J. E. Wolff, Cambridge, Mass.—This paper describes the structure of these mountains, which are composed of Cretaceous strata, horizontal or but gently inclined, cut by numerous narrow vertical dikes and large irregular masses, as well as great bulging intrusive sheets of laccolites, which have been tilted with the strata. Brief descriptions are given of the eruptive rocks and of the contact metamorphism produced by them.

THE CUBOIDES ZONE AND ITS FAUNA. A DISCUSSION OF METHODS OF CORRELATION. H. S. Williams, Ithaca, N. Y.—In this paper, after discussion of the principles of correlation, and after comparisons of fauna of this zone in Europe and Asia, as well as in America, the author comes to these conclusions:

That the fauna of the Tully limestone of New York is the representative of the fauna of the Cuboides zone of Europe homotaxially; that the relations of the two faunas may be best explained by the hypothesis that the fauna of the Tully limestone is not a direct sequent of the underlying Hamilton fauna alone, but in its characteristic species shows evidence of community with European faunas to be explained by migration.

A comparison of all the related faunas at present known leads to the conclusion that the Cuboides and Tully faunas are not only homotaxial but relatively contemporaneous, the margin of difference in the time of the existence of the two faunas probably not greater than the period of existence of the Cuboides fauna in its typical localities in Europe.

THE INTERNAL RELATIONS AND TAXONOMY OF THE ARCHÆAN OF CENTRAL CANADA. Andrew C. Lawson, Ottawa, Canada.—Archæan comprises two great systems, Lower (Laurentian), composed of plutonic igneous rocks; Upper, of indubitably normal surface rocks, variously altered. Lower, irruptive through Upper and of younger age, piercing the latter, holding detached fragments from its shattered margin, and inducing contact metamorphism. Conception of Archæan suggested by the facts: Its ideal simplicity; complications; combined effect of plutonic irruptions and crust-crumbling forces. Geognostical equivalents of Laurentian elsewhere found to be eruptive.

THE CRYSTALLINE SCHISTS OF THE BLACK HILLS OF DAKOTA. C. R. Van Hise, Madison, Wisconsin.—A review of the distribution of the slates, schists, and granites is given as mapped by Newton. Cross lamination, and the arrangement of pebbles in the conglomerates, show that the real thickness of the slates is independent of their apparent thickness as measured by cleavage. The largest area of crystalline schist is a belt surrounding the granite mass in the southern part of the pre-Cambrian area. It always strikes parallel to and dips away from the granite. The structure is then here laccolitic. The granite, by its contact and dynamic action, produced these crystalline schists. The evidences of fragmental origin in clastic rocks is generally retained when subject to pressure only, however great the pressure. The evidences of fragmental origin in clastic rocks is rapidly obliterated when they have been subject to dynamic action. Illustrations: The original detritus of the Black Hills mica-schist was feldspar and quartz. By a decomposition of the former, producing mica and quartz, and a breaking down of the larger particles of the latter by dynamic action, coarse, even granular, completely crystalline mica schists have been extensively produced. Different degrees of crystalline character are seen in the field, and various stages of the change are traced out in thin section. The paper then speaks of the age of the slates, schists, and granites.

SOME RESULTS OF ARCHEAN STUDIES. By Alexander Winchell, Ann Arbor, Mich.—This memoir is a condensed statement of observations made by the author in northern Minnesota and contiguous regions. With these are incorporated some records of other observers in the same field. Being simply a report of facts observed, the memoir is calculated to stimulate inquiry rather than provoke discussion. The field is thought to be one of such comparative simplicity of structure as to promise a much easier solution of the Archean problem than any of the complicated regions of New England and eastern Canada. Several systems of rocks are enumerated in succession, distinguished by structural relations, and lithological and mineralogical contrasts. These are, in descending order: V. The uncrystalline schists (Animikie); IV. The sub-crystalline schists (Kewatin of Lawson); III. The crystalline schists (Vermilion of N. H. Winchell); II. The gneissoid rocks; I. The granitoid rocks (not fundamentally distinct from the gneissoid). The oldest four of these systems exhibit an unexpected stratigraphical conformity with each other, and a stratigraphical and mineralogical intergradation, which seems to unite them in closer

historic continuity than could be, admitted on the consideration of their enormous volumes, their disparity of age, and their widely contrasted lithological facies. The fifth system is shown to lie in wide structural discordance with the older ones, and to be in every respect impossible of identification with the IVth system, with which Irving confounded it under the designation "Huronian." The four oldest systems are geographically and structurally distributed over a number of oval or irregular areas, each revealing granitoid rocks in the centre, and gneissoid rocks and crystalline schists in successive concentric bands, with the subcrystalline schists filling the intervals between the crystalline schists of neighboring areas. The granitoid and gneissoid centres appear to have been protruded, and crowded mutually upon each other, until the intervening subcrystalline strata have been thrown into closely folded synclinal attitudes. These schists, consequently, are vertical in position, and the crystalline schists and gneisses succeed them in close parallelism. Toward the centre of each area, the gneisses, even while maintaining their verticality, sustain anticlinal relations to each other. But sometimes, in approaching the centre, a dip towards the periphery supervenes, and this diminishes to horizontality. The centre of the area is not always occupied by granitic rocks. In some cases, they are strictly gneissoid. The state of the facts may be easily comprehended by conceiving all the systems originally in a horizontal position, and conformably superposed in the order indicated—then an up-swelling in places, which, with shrinkage of the terrestrial crust, would crowd the higher beds into interareal synclinal olds as we find them.

Thus, if we had only the geology of the Northwest to settle, the Archean question would be simple. Older observations in more difficult regions have created questions of correlation which the canons of science require us to answer. But these and other questions of a speculative character are postponed to future occasions.

ORIGIN OF THE ROCK-PRESSURE OF NATURAL GAS IN THE TRENTON LIMESTONE OF OHIO AND INDIANA. Edward Orton, Columbus, Ohio.—In this paper the author defines the term rock-pressure: shows the decrease in rate westward: discusses theories of origin already offered: presents facts supporting the theory of hydrostatic origin: offers conclusions respecting duration of gas-supply in Ohio.

ON POT-HOLES NORTH OF LAKE SUPERIOR UNCONNECTED WITH EXISTING STREAMS. Peter McKellar, Fort William, Ontario.—This paper deals with some large and remarkable "Kettles" or "pot-holes"

some distance back from the Lake, and at a considerable elevation above the present level. They must have been produced by a very swift current of large volume, yet there is no existing stream near them. The direction of the torrent is examined. The well-marked high terraces of the north shore of Lake Superior are considered in this connection, also the lines of depression through the low watershed between Lake Superior and Hudson's Bay.

ON THE PLEISTOCENE FLORA OF CANADA. Sir William Dawson and D. P. Penhallow, Montreal, Canada.—The Pleistocene deposits of Canada were defined as consisting of three principal members.

First.—The Till or Lower Boulder Clay, containing local and traveled stones and boulders, often glaciated and resting on glaciated surfaces. In the more maritime regions, *e. g.*, the lower St. Lawrence, it contains marine shells of arctic species. Further inland, *e. g.*, in Western Ontario and the plains west of Red River, it is not known to hold marine remains.

Secondly.—Stratified clays and sandy clays which in the more maritime and lower regions are the "Lower and Upper Leda Clays," holding many maritime shells and drift plants, etc., indicating neighboring land. In the interior they hold more abundant vegetable remains and locally beds of peat, and also fresh-water shells. These beds have been known as "Interglaciæ."

Thirdly.—Sands, clays, and gravels, often stratified, sometimes containing traveled boulders throughout; in other cases having boulders below and above. These beds in the maritime region contain sea-shells; further inland they are unfossiliferous. They constitute a second or newer boulder formation, and their traveled boulders are often of large size, and found at greater elevations than that of the lower boulder clay.

Above these are alluvial deposits, lakes, terraces, gravels, and eskers—prairie-silt, peat deposits, etc., which may be regarded as modern, or post-glacial.

The plants referred to are contained principally in the second formation, but when, as sometimes happens, this is absent, drift vegetable fragments are found in the boulder clay.

The phenomena point to extensive changes of level and climate going on throughout the pleistocene, in which, while the high lands were occupied with snow and glaciers, and the submerged plains and valleys were filled with floating ice, there were throughout, and especially in the central period, oases occupied with vegetation, in the

manner so well explained by Fielden as now occurring within the Arctic circle.

The plants procured had in part been described and figured in papers published by Sir W. Dawson in the Canadian *Naturalist*. They constitute a cold, temperate, or boreal flora, composed of species still living in the region of the Lawrence and its lakes, and northward. Professor Penhallow has kindly undertaken to review the material previously described, and to examine a number of specimens recently obtained, and presents a detailed list and notes of the forms described.

Boston Society of Natural History.—December 4, 1889, Dr. R. T. Jackson discussed certain points in the development of the Mollusca. Dr. J. Walter Fewkes described a remarkable instance of rock excavation by Sea-Urchins.

December 18, Dr. Frederick Tuckerman read a paper on the "Gustatory Organs of Mammals." Mr. S. H. Scudder made a few remarks on fossil plant-like.

January 1, 1890, there was a discussion of "The Climatic Conditions of the Glacial Period."

February 5th, Prof. F. W. Putnam spoke on "Early Man in America," and brought forward some new evidence of the contemporaneity of man with the mastodon. Mr. S. H. Scudder made a few remarks on a small collection of beetles from the inter-glacial clays of Scarboro', Ontario.

February 19th, Mr. Samuel Garman read a paper on "Some Recent Discoveries in Caves." Prof. W. O. Crosby spoke on "A Large Granite Boulder in Madison, New Hampshire," and on "The Occurrence of Decomposed Granite in Blandford, Massachusetts."

March 5th, Prof. W. O. Crosby called attention to an "Interesting Occurrence of Decomposed Granite in Blandford, Massachusetts." Dr. J. Walter Fewkes read a paper on "Some Rare Marine Animals from California."—J. WALTER FEWKES, *Secretary*.

New York Academy of Sciences.—March 10, 1890, the following paper was read: "On Geographical Variations in the Horned Larks of North America," by Jonathan Dwight, Jr.—H. CARRINGTON BOLTON, *Secretary*.

Chicago Academy of Sciences.—March 11th, Maj. Gen. Geo. Crook, U. S. A., held a conversazione. Subject: "The Mode of Warfare, Life, and Character of the American Indians."—C. E. WEBSTER, *Recorder*.

The Chicago Institute for Instruction in Letters, Morals and Religion.—A course of lectures on the testimony of science to evolution has been held in Rehearsal Hall, in the new Auditorium Building, as follows :

November 22, Prof. E. W. Claypole, D. Sc., F. G. S., Akron, Ohio, "The Development and Destiny of the Earth."

December 6, Prof. T. J. Burrill, Ph.D. (University of Illinois), "Lessons from Leaves, Flowers and Fruits."

December 20, Pres. David Starr Jordan (University of Indiana), "Evolution and the Distribution of Animals."

January 3, Prof. Alexander Winchell (University of Michigan), "The Paleontological Evidences of Evolution."

January 17, Prof. W. K. Brooks (Johns Hopkins University), "Embryology and Evolution."

February 7, Prof. Edward S. Morse (Director Peabody Academy of Science, Salem), "Variation and Inheritance as Factors of Natural Selection."

February 21, Prof. S. A. Forbes (University of Illinois), "Entomological Illustrations of Evolution."

March 7, Prof. E. D. Cope (University of Pennsylvania), "Causes and Agencies of Evolution."

March 13, Prof. John Fiske (Cambridge, Mass.), "The Doctrine of Evolution ; its scope and influence."

Proceedings of the Natural Science Association of Staten Island.—December 12, 1889. Meeting called to order at 8.20 o'clock. A paper on the Carabidæ of Staten Island, by Mr. Charles W. Leng, was read by the corresponding secretary.

The corresponding secretary read by title a paper by Mr. William T. Davis, upon the homestead graves of the island, which will be issued as a special number of the proceedings.

Mr. Joseph Thompson showed *Cecropia* cocoons which had been eaten by field mice.

Mr. Arthur Hollick showed specimens of wheat in which the grains had all sprouted while in the ear. The specimens were from stacks in a field on the Vanderbilt farm at New Dorp. The grain in all the stacks was in the same condition—due to the phenomenal wet season.

Adjourned at 9.45 o'clock.

February 13, 1890. Amongst the various communications read was one from a prominent resident of the island, offering to donate half an acre of land for the building. The secretary was not, however,

authorized to make public the donor's name. Attention was also called to the many favorable notices of the enterprise in the local papers and elsewhere.

The old milestone, formerly standing at the junction of Signs Road and Richmond Turnpike, was on exhibition, having been secured by the association since the last meeting. This was supposed to be the last one remaining on the old post route between New York and Philadelphia, or at least upon that portion of it which crossed Staten Island. The stone is considerably the worse for wear, the upper part having been chipped off, possibly for momentos, thus destroying part of the inscription, which now reads :

Miles
to
N. YorkE

The figures denoting the distance were doubtless upon the part which was chipped away. This old and interesting relic of bygone times has been secured none too soon, and the association is to be congratulated upon having secured and placed it where it will be safe from further danger. In this connection Mr. Arthur Hollick stated that at some future meeting it was expected that a paper upon the subject would be presented, and then read the following brief abstract from Clute's History of Staten Island :

"After Governor Tompkins had laid out and opened the Richmond Turnpike stages ran regularly over the whole length of the new road, in connection with steamboats from New York, and constituted part of the route of travel between New York and Philadelphia. At the western terminus of the Turnpike stages were carried over the sound by means of large scows, and this ferry received the name of the 'New Blazing Star.' "

A mummified rat was shown, presented by Mr. Daniel Campbell. The animal had contrived to force its way into an angle between a beam and the cellar wall of a dwelling in New Brighton, and for some reason had been unable to extricate itself. The remains were thoroughly dessicated and excellently preserved.

Mr. E. M. Eadie presented a large piece of drift rock from Old Place, probably Oriskany sandstone, containing *Spirifer arrectus*.

Biological Society of Washington.—October 19, 1889, the following communications were read: Dr. C. Hart Merriam, "Description of a new *Spermophile* from the Painted Desert, Arizona;" Mr. Theo. Holm, "The Ancestors of *Liriodendron tulipifera*;" Mr. Theo. Gill, "On the *Dactylopteroidea*."

November 2, 1889, the following communications were read : Prof. C. V. Riley, "The Remarkable Increase of *Vedolia cardinalis* in California ;" Mr. W. H. Dall, "Notes on the Genus *Gemma* Deshayes ;" Dr. George Marx, "On a new Spider and its Influence on Classification ;" Dr. C. Hart Merriam, "Remarks on the Spotted Skunks (Genus *Spilogale*) with Descriptions of New Forms."

November 30, 1889, the following communications were read : Dr. Theobald Smith, "Preliminary Observations on the Micro-organisms of Texas Fever ;" Dr. D. E. Salmon, "General Remarks on Texas Fever, illustrated by Lantern Slides ;" Mr. C. D. Walcott, "Description of a New Genus and Species of Inarticulate Brachiopod from the Trenton Limestone ;" Dr. Frank Baker, "An Undescribed Muscle of the Infraclavicular Region in Man."

December 14, 1889, the following communications were read : Dr. C. Hart Merriam, "Results of a Biological Survey of the San Francisco Mountain Region in Arizona ;" Mr. C. D. Walcott, "A New Genus and Species of Ostracod Crustacean from the Lower Cambrian ;" Dr. A. F. A. King, "On the Flight of Young Birds."

December 28, 1889, the following communications were read : Dr. A. F. A. King, "On the Flight of Young Birds ;" Mr. M. B. Waite, "On the Method by which the Seeds are Projected in *Pilea pumila* ;" Dr. C. Hart Merriam, "A New Red-backed Moose (*Evotomys*) from Colorado ;" Mr. Theodore Holm, "Generic Characters of *Gramineæ* and *Cyperaceæ*, taken from the Structure of the Leaves."

February 8, 1890, the following communications were read : Dr. Frank Baker, "An Undescribed Muscle from the Infraclavicular Region of Man ;" Mr. C. D. Walcott, "A New Genus and Species of Ostracod Crustacean from the Lower Cambrian ;" Dr. Cooper Curdice, "The Moultings of the Cattle Tick ;" Prof. Lester F. Ward, "The Flowers that Bloom in the Winter Time."

March 8, 1890, the following communications were read : Mr. B. T. Galloway, "Notes on a Fungous Disease of the Apple ;" Mr. C. L. Hopkins, "Animal Life Observed above Snow Line on Mt. Shasta," "Notes upon the Timber and Timber Line of Mt. Shasta ;" Mr. W. H. Dall, "On Dynamic Influences in Evolution."—FREDERIC A. LUCAS, *Secretary*.